Precipitation Forecast Improved with a New Convective Triggering Mechanism

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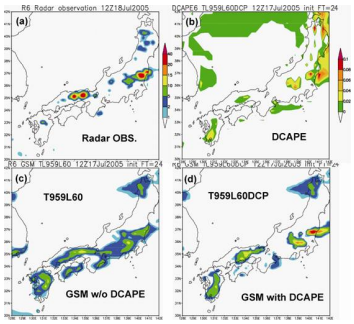
Research Highlight

An improved convective triggering mechanism developed by ARM scientists based on ARM observations was implemented recently in the Global Spectral Model (GSM) at the Japan Meteorological Agency (JMA) to improve surface precipitation forecasts. The new triggering mechanism introduces a simple dynamic constraint on the initiation of convection that emulates the collective effects of lower-level moistening and upward motion of the large-scale circulation. It allows convective available potential energy, or CAPE, to accumulate from surface processes before convection occurs and links model deep convections closely to the large-scale dynamical processes.

With the new triggering mechanism, the revised JMA's GSM (T959L60DCP) substantially reduced the precipitation bias in the original T959L60 global model, which tends to overestimate weak precipitation area especially from local noon to late afternoon over Japan (See Figure 1). The predicted geographic distribution of precipitation and the intensity of strong precipitation events by T959L60DCP are much closer to observations than the original model.

Since November 2007, the new convective triggering mechanism has been used in the JMA's global model for operational weather forecasts.



Six-hour accumulated precipitation valid at 12 UTC 18 July 2005. (a) Radar Observation, (b) DCAPE, (c) GSM without the DCAPE trigger, and (d) GSM with the DCAPE trigger. Considerable improvement of precipitation forecast is obtained by the GSM with the new trigger compared to the radar observation. (Courtesy of Dr. Masayuki Nakagawa/Japan Meteorological Agency.)

Reference(s)

Xie, S., and M. Zhang (2000), Impact of the convective triggering function on single-column model simulations. J. Geophys. Res., 105, 14983-14996

Working Group(s)

Cloud Modeling